

Immediate Fatal Outcome *vs.* Fatal Outcome within the First 48 Hours Following a Severe Traffic Trauma – Analysis of the Possible Effect of Alcohol Intoxication on the Outcome

Srđan Čalošević¹, Mladen Marcikić², Zvonimir Lovrić³ and Suzana Čalošević⁴

¹ Emergency Medical Center of the Osječko-baranjska County, Osijek, Croatia

² »J.J. Strossmayer« University, Osijek University Hospital Center, Department of Pathology and Forensic Medicine, Osijek, Croatia

³ University of Zagreb, Dubrava University Hospital, Department of Surgery, Section of Traumatology, Zagreb, Croatia

⁴ »J.J. Strossmayer« University, Osijek University Hospital Center, Physical Medicine and Rehabilitation, Osijek, Croatia

ABSTRACT

This paper is a retrospective analysis of data on 278 persons with fatal outcomes in traffic accidents in Osječko-baranjska County, Croatia, during a five-year period. The observed sample of casualties was divided according to the time of fatal outcome into three groups: immediately deceased (139 or 50.0%), deceased within the first 48 hours (84 or 30.2%) and deceased after 48 hours (55 or 19.8%). A comparison of data was made for the first two groups of casualties, based on the level of alcohol intoxication, and an analysis of the possible influence of alcohol intoxication on an early outcome of severe trauma, which was defined as immediate fatal outcome and fatal outcome within the first 48 hours following the trauma. Casualties from the group of immediately deceased had a significantly higher average blood alcohol level than casualties from the group of persons deceased within the first 48 hours (shown through arithmetic mean of 0.81 g/kg vs. 0.33 g/kg, $p=0.000$). A binary logistic regression analysis showed that every increase in blood alcohol level by 1 g/kg also increased the odds of an immediate fatal outcome by 1.92 times ($p=0.004$). Conclusion: Beside increased risks of traffic accidents, the collected data showed that alcohol intoxication of accident participants also increases their chances of an immediate fatal outcome.

Key words: traffic accidents, fatal outcome, alcohol intoxication

Introduction

The place and the role of a person injured in traffic are very important because different groups of traffic participants have specific patterns of injuries. Their bodies are affected by different destructive forces, and the frequency and measures in the primary prevention of injuries are also different. Results of studies like this one can be applied in a variety of areas that deal with increasing traffic safety: vehicle and protection systems design, legal traffic regulation, expert opinions in criminal proceedings, etc.

In respect to types of traffic participants we can distinguish between six groups: drivers, front-seat passengers, passengers, motorcyclists, bicyclists and pedestrians¹.

The relationship between alcohol and traffic accidents is a problem to which a great deal of attention is attributed on everyday basis. This paper analyses, by means of a short overview, the role of alcohol as a cause of traffic accidents, in the way that the presence of alcohol intoxicated people was observed in persons who are ac-

tive traffic participants (persons who due to their alcohol intoxication could cause a traffic accident: drivers, pedestrians, bicyclists and motorcyclists).

The alcohol intoxication as an important factor in trauma outcomes has been researched in detail.

Subjects and Methods

During the period between 01.01.1995 and 31.12.1999 at the Department of Pathology and Forensic Medicine of the Osijek University Hospital Center an autopsy was done on 278 people who died due to injuries sustained in traffic accidents. Considering the legal obligation that an autopsy must be done on all persons deceased in traffic accidents, we can assume that this is also the total number of deceased in the area that gravitates toward the University Hospital Osijek.

In this research the following records were used:

- autopsy findings from the Department of Pathology and Forensic Medicine archives of the Osijek University Hospital Center;
- intervention protocols of the Emergency Medical Center in Osijek;
- expert witness findings from the records of the County court in Osijek.

From these records the following data were extracted: age and gender of the deceased, time of injury, time of death, time passed until emergency medical assistance was provided, type of traffic participants, blood alcohol level.

In respect to the time of death the deceased were divided into three groups: immediately deceased, deceased within the first 48 hours and deceased after 48 hours.

Statistics

The database in which the data received was entered was created in the computer program Access, from the MS Office package. For statistical data processing, drawing tables and diagrams, the computer program SPSS (Statistical Package for Social Science, SPSS 9.0 for Windows)² was used.

The differences in values of blood alcohol levels in the two groups of deceased (immediately deceased and deceased within the first 48 hours) were tested by means of the Mann-Whitney U-test also known as the Wilcoxon's test.

Binary logistic regression analysis tested the significance of the relationship between the blood alcohol level as an independent variable and early outcome of severe trauma (either the immediate fatal outcome, or the fatal outcome within the first 48 hours) as a dependent variable³⁻⁶. No adjustments for impact of the potential confounders were done.

This analysis observes the odd's ratio of an event in paired casualties who coincide in all variables but in the researched one. Therefore, the mathematical model implies that casualties from the sample can be paired in age, gender, type, severity of injury, etc., and, by analyzing the alcohol intoxication, it shows the odd's ratio of an immediate fatal outcome and a fatal outcome within the first 48 hours.

Results

Out of 220 persons from the group of immediately deceased and deceased within the first 48 hours, 98 (44.55%) were tested positive for blood alcohol: from 0.11 to 3.95 g/kg (for three of the deceased there were no records available for blood alcohol levels). The seventy-four deceased (33.63%) had a blood alcohol level of 0.51 g/kg and more; while sixty (27.27%) had a blood alcohol level above 1 g/kg (Table 1).

If one excludes the front-seat passengers and passengers in motorized vehicles, who are passive participants, we come to the fact that out of 173 active participants in traffic accidents (drivers, bicyclists, motorcyclists and pedestrians from the group of immediately deceased and the group of deceased within the first 48 hours) in this sample, 85 of them (49.13%) tested positive for blood alcohol. The sixty-three of them (36.42%) had an alcohol level of 0.51 g/kg and more (up to 3.95 g/kg that was found in one bicyclist) (Table 2).

It is evident in Table 2 that drivers contribute the largest share of these devastating results: 38 drivers out of a total of 61 (62.3%) were intoxicated, as much as 26 (42.6%) had a blood alcohol level of 0.51 g/kg and more, up to the maximum level of 3.39 g/kg.

Figure 1 shows the mean values of blood alcohol level in the blood of 138 injured from the group of those immediately deceased and 82 from the group of those deceased within the first 48 hours.

The mean value has been shown as the arithmetic mean of blood alcohol level in g/kg: 0.81g/kg *vs.* 0.33 g/kg.

TABLE 1
DIVISION OF BLOOD ALCOHOL LEVELS IN IMMEDIATELY DECEASED AND DECEASED WITHIN THE FIRST 48 HOURS

Group	Blood alcohol level (g/kg)									Total
	Unknown	No alcohol	0.01–0.50	0.51–1.00	1.01–1.50	1.51–2.00	2.01–2.50	2.51–3.00	>3.00	
Immediately deceased	1	64	17	7	13	13	11	10	3	139
Deceased within the first 48 hours	2	58	7	7	5	0	1	2	2	84
Total	3	122	24	14	18	13	12	12	5	223

TABLE 2
DIVISION OF BLOOD ALCOHOL LEVELS IN ACTIVE PARTICIPANTS OF TRAFFIC ACCIDENTS (DRIVERS, BICYCLISTS, MOTORCYCLISTS, PEDESTRIANS)

Active participants	Blood alcohol level (g/kg)								Total
	No alcohol	0.01–0.50	0.51–1.00	1.01–1.50	1.51–2.00	2.01–2.50	2.51–3.00	>3.00	
Bicyclists	16	0	2	4	1	2	1	2	28
Motorcyclists	7	1	1	2	0	0	1	0	12
Pedestrians	42	9	4	3	2	4	7	1	72
Drivers	23	12	4	6	9	3	3	1	61
Total	88	22	11	15	12	9	12	4	173

Mann-Whitney U-test of the difference in blood alcohol levels showed that the immediately deceased had a statistically significant increase of blood alcohol level than the ones deceased within the first 48 hours ($p=0.000$).

In the group of immediately deceased, in ten persons the direct cause of death was drowning because at the time of accident they were submerged in water. The mean age value of this group of casualties was 28.33 (min. 23, max. 42) and the mean value of ISS and NISS (New Injury Severity Score, NISS) as a measure of the total severity of their injuries was 12 (min. 2, max. 18), i.e., 14.83 (min. 2, max. 34). The mean value of the blood alcohol level in this group was 1.11 g/kg (min 0.50 g/kg, max 2.82 g/kg).

An analysis was made of significance in the difference in alcohol intoxication between the group of subjects who drowned and the alcohol intoxication in the group of immediately deceased and the subjects deceased within the first 48 hours:

- Mann-Whitney U-test of the difference in blood alcohol levels in the 10 deceased whose cause of death was drowning and the 128 of those left in the group of immediately deceased did not show a statistically significant difference ($p=0.380$);
- however, when testing the difference in alcohol intoxication in the 10 drowned and 82 of those from the group of deceased within the first 48 hours by means of the Mann-Whitney U-test, it was proved that those who were drowned had statistically significant higher levels of blood alcohol ($p=0.016$).

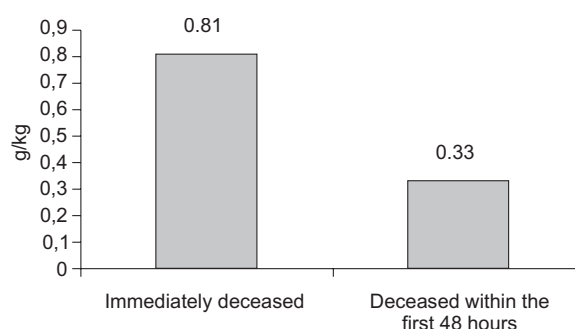


Fig. 1. Mean values of blood alcohol levels.

The difference in blood alcohol levels was analyzed in the two groups of subjects (immediately deceased and deceased within the first 48 hours) after the casualties had been excluded whose main cause of death was drowning. The data on alcohol intoxication were available for 210 casualties.

The difference in alcohol intoxication between the 128 casualties from the group of immediately deceased and 82 casualties from the group of deceased within the first 48 hours is significant ($p<0.001$), if those who drowned are excluded.

In the previously mentioned analysis the difference in the level of alcohol intoxication between the two groups of casualties was tested.

In the following analysis, alcohol intoxication as an independent variable was included in a binary logistic regression analysis so that one could research its effect on the early outcome of severe trauma.

TABLE 3
EFFECT OF INCREASED BLOOD ALCOHOL LEVELS ON THE INCREASE OF THE RELATIVE RISK OF IMMEDIATE FATAL OUTCOME

Variable	β	SE of β	OR	95% CI	p
Logistic regression with actual alcohol values					
Alcohol intoxication	+0.6531	0.2289	1.9215	1.226–3.009	0.004
Logistic regression with binary coded alcohol intoxication					
Alcohol > 1.5 g/kg	+1.8754	0.5755	6.5232	2.111–20.152	0.001

β – explanatory variable coefficient, SE of β – standard error of coefficient β , OR – Odds Ratio: odds ratio or relative risk, CI – Confidence Interval

An early outcome of severe trauma is considered either:

- death on the site of the accident (the group of immediately deceased),

or,

- death in a hospital up to 48 hours following the accident (group of those deceased within the first 48 hours).

Out of 213 casualties (from both groups) three were excluded from the analysis because data on blood alcohol levels were not available.

The result obtained showed that, in this sample of casualties, an increase of blood alcohol level has a statistically significant effect by increasing the chance of an immediate fatal outcome (Table 3).

The analysis showed that an increase of blood alcohol level by 1 g/kg, increases the odds by 1.92 times that a person of a certain age with certain types of injuries will die immediately on the site of the accident. The range of 95% of reliability showed that the odds' ratio is between 1.23 and 3.01 (Table 3).

Furthermore, blood alcohol level was transferred from its continuing form into a binary category form in the following way: blood alcohol level of up to 1.5 g/kg as one category and more than 1.5 g/kg as the other.

The binary variable obtained in this way was included in the binary logistic regression analysis as independent so that its relation to the early outcome of severe trauma as a binary dependent variable could be tested.

The analysis showed that persons with a blood alcohol level of more than 1.50 g/kg have 6.52 times higher odds of an immediate fatal outcome in comparison to persons whose blood alcohol level is less than this value (Table 3).

Discussion

Alcohol consumption has a multiple negative affect at traffic safety and the safety of its participants. This is mostly evident in the increased possibility that traffic participants will cause an accident if they are in the state of alcohol intoxication. Furthermore, there is a much higher possibility that alcohol intoxicated drivers will drive at higher speed and because this can lead to more devastating traffic accidents, and by that more severe injuries to the participants of traffic accidents. When a traffic accident has already occurred and caused injuries to participants, a question can be raised of what effect the increased blood alcohol level has had at the outcome of injuries? This issue is justified by the fact that alcohol intoxicated participants made 44.55% of all casualties.

The problem of alcohol as a cause of traffic accidents is already well known^{7–9}. The term »active participants of traffic accidents« was given to participants who due to their alcohol intoxication can cause the accident itself (drivers, bicyclists, motorcyclists and pedestrians). The share of alcohol intoxicated participants was even higher in this group (49.13%). During the study period, the

blood alcohol content for traffic participants was limited to less than 0.5 g/kg. More than 1/3 of all casualties had higher alcohol levels, particularly car drivers. Due to their role in traffic, car drivers are among potentially most dangerous traffic participants.

The relationship between ISS (Injury Severity Score, ISS) as a measure of total severity of injury and alcohol level is discussed in the study Pollack CV and Pollack SB: ISS was larger in those who had consumed alcohol than in those who had not (8.12 ± 5.79 to 4.76 ± 4.67)¹⁰. Patricia Dischinger et al. in their study, done in 2001, report that casualties with minimal injuries were rarely found positive in toxicological tests in comparison to the casualties with massive injuries (30.4% vs. 48.8%). Beside that, the mortality rate in those who tested positive at a toxicological test was almost twice higher than in those who tested negative (1.9% vs. 1.0%, $p < 0.001$)¹¹.

The depressant effect of alcohol intoxication plays a significant role as a risk factor of a fatal outcome, especially in casualties with injuries categorized as moderate brain or lung injuries¹². In contrast, Stuke et al. concluded in their study that alcohol intoxication did not significantly change the value of GCS in those injured with craniocerebral trauma although the ones who were intoxicated suffered more frequently a head trauma¹³.

Jurkovich et al. report in their study the results according to which the trauma outcome is significantly affected by chronic alcohol abuse, whereas acute alcohol intoxication has no effect¹⁴.

In the here presented group of casualties whose direct cause of death was drowning, a conclusion can be made that the alcohol intoxication affected significantly the adverse outcome of the immediate fatal outcome. These were young persons whose injuries were not of such nature that would end in a fatal outcome. We can assume that the described high blood alcohol level (mean value of blood alcohol levels was 1.11 g/kg, ranging from 0.50 to 2.82 g/kg) contributed to adverse outcomes in young persons whose injuries were serious, but not inevitably lethal.

If we exclude the drowned from this analysis, who died under specific circumstances, we are left with a sample of 210 casualties from the group of immediately deceased and those deceased within the first 48 hours. If we test the difference in alcohol intoxication between these two groups of casualties by means of the Mann-Whitney U-test, we can conclude that the casualties from the first one had statistically significant higher levels of blood alcohol.

Regression is used to test whether alcohol intoxication can influence chances of an immediate fatal outcome. Binary logistic regression analysis with the blood alcohol level as a continued independent variable provided us in the group observed with the following result: every increase of alcohol intoxication by 1 g/kg increases the odds of an immediate fatal outcome by 1.92 times.

If we transfer the blood alcohol level into a binary variable, we can conclude that the odds of an immediate

death outcome increase by 6.52 times in persons with higher levels of alcohol.

The measures of primary prevention of traffic accidents and their consequences include the legal framework and its consistent implementation. Limit alcohol consumption is one of the most important elements of these regulations.

The intended aim of the study was not to explore the incidence of alcohol consumption among participants of

traffic accidents, but it did show an unexpectedly high proportion of participants under the influence of alcohol. The measures of secondary prevention of consequences of traffic accidents also include emergency medical help (concerning traumatologic »golden hour« and »platinum five minutes«). Here presented effect of alcohol on increased risk of immediate death outcomes suggests that alcohol intoxication can significantly deteriorate results of the emergency medicine measures, since some of them will be already dead in the moment of help arrival.

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S. Čalošević

Emergency Department of Osječko-baranjska County, J. Hutlera 2, 31000 Osijek, Croatia
e-mail: scalosev@gmail.com

NEPOSREDNI SMRTNI ISHOD VS. SMRTNI ISHOD U PRVIH 48 SATI NAKON TEŠKE PROMETNE TRAUME – ANALIZA MOGUĆEG UTJECAJA ALKOHOLIZIRANOSTI NA ISHOD

SAŽETAK

Rad je retrospektivna analiza podataka o 278 osoba sa smrtnim ishodom u prometnim nezgodama na području osječko-baranjske županije tijekom petogodišnjeg razdoblja. Promatrani uzorak stradalih je na temelju vremena smrtnog ishoda podijeljen u tri skupine: neposredno preminuli (139 ili 50,0%), preminuli u prvih 48 sati (84 ili 30,2%) i preminuli nakon 48 sati (55 ili 19,8%). Napravljena je usporedba podataka o stupnju alkoholiziranosti prve dvije skupine stradalih te analiza mogućeg utjecaja alkoholiziranosti na rani ishod teške traume koji je definiran kao neposredni smrtni ishod ili smrtni ishod u prvih 48 sati nakon traume. Stradali iz skupine neposredno preminulih imali su značajno veće prosječne koncentracije alkohola u krvi nego stradali iz skupine preminulih u prvih 48 sati (iskazano kroz aritmetičku sredinu 0,81 g/kg vs. 0,33 g/kg, $p=0,000$). Pri tomu je binarnom logističkom regresijskom analizom utvrđeno da je svako povećanje koncentracije alkohola u krvi za 1 g/kg povećavalo šansu neposrednog smrtnog ishoda za 1,92 puta ($p=0,004$). Zaključak: Uz nesumnjivo povećanje rizika od prometne nesreće, alkoholiziranost značajno povećava šansu neposrednog smrtnog ishoda njenih sudionika.